CHANGING ECONOMICS OF INFORMATION PROCESSING IN LARGE U.S. CORPORATIONS

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Changing Economics of Information Processing in Large U.S. Corporations

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1 INTRODUCTION

I INTRODUCTION

- This digest examines the changing nature of information processing expenditures in large organizations, from the early stages of IBM System 370 introduction in 1974 through the beginning of the breakdown of centralized processing (typically using IBM 303X or equivalent mainframes), into 1980's distributed processing (typically using IBM 4300 series or equivalent systems).

- Analysis first focuses on the components of EDP controlled budgets in 1974, then develops comparisons with similar budgets in 1980.

- Discussion centers on the recognition that EDP budgets, though growing, are not changing to the same extent as the end user components which comprise total organization information processing expenditures.

- Drawing from research contained in earlier INPUT reports rationales are presented for the observed increases in end user expenditure rates in eight categories:

  - Applications software.

  - Personal computers.

  - Computer services.

  - Distributed processing.

- Communications.

- Terminals.

- Office automation.

- Personnel.

- The study concludes that the EDP executive is losing control over total organization information processing costs to end users through a process INPUT has termed "leakage."

- Recognizing that chief operating officers consider information processing vital for both survival and growth, the study presents a future organizational structure in which the information processing executive has effective planning and budgeting responsibility over organizationwide information services.

A. HISTORICAL PERSPECTIVE

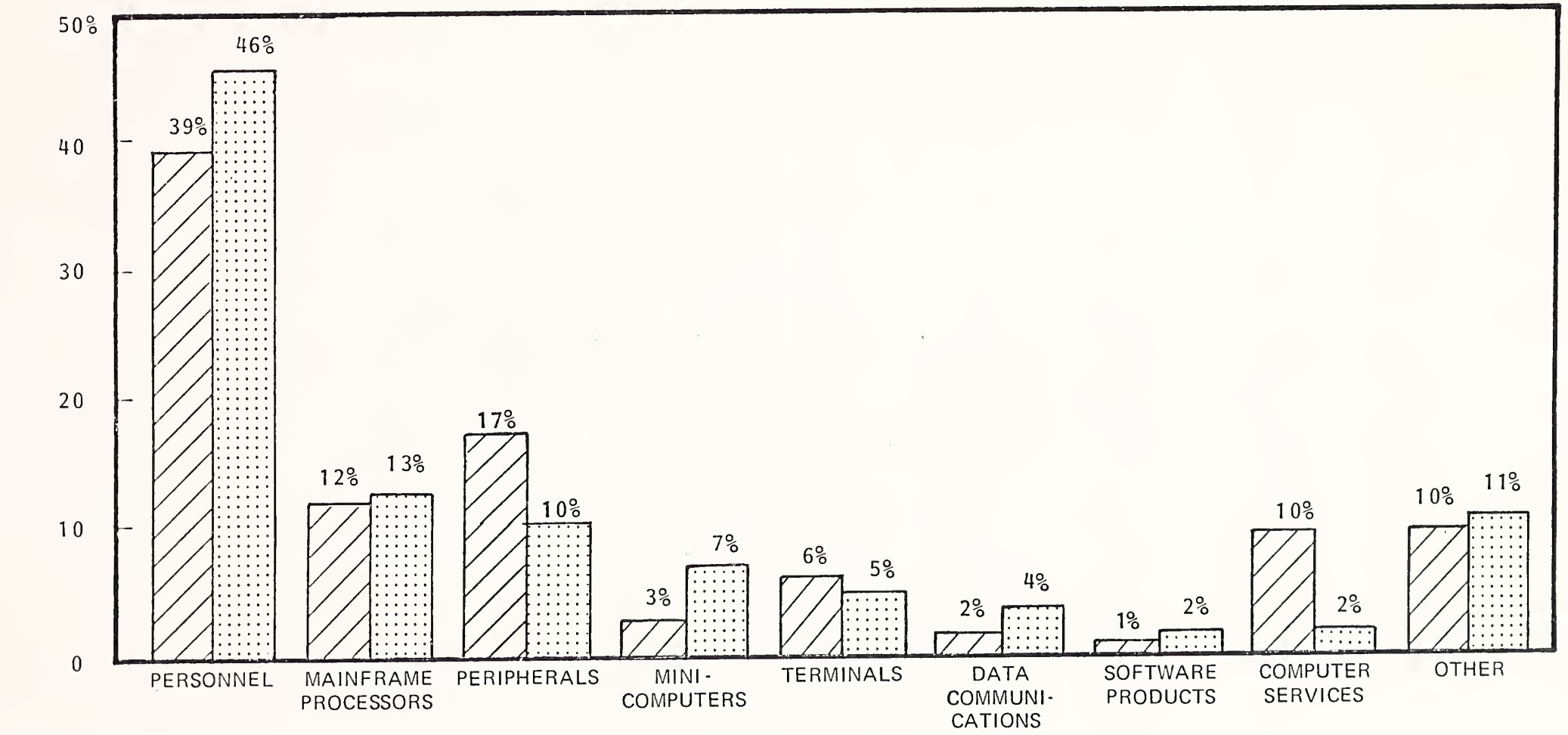
- INPUT has been collecting data on EDP budgets since 1975. In a multiclient study, The Impact of the Recession on U.S. EDP Budgets in 1975 and 1976, INPUT gathered data from nearly 120 EDP and financial managers of Fortune 500/50 companies on their actual 1974, planned 1975 and expected 1976 EDP budgets.

- Data were collected across six major industry groups and for the nine budget categories shown in Exhibit I-1.

  - Equipment expenditures were determined on an equivalent rental basis and included maintenance.

EXHIBIT I-1

RELATIVE CHANGE IN RESPONDENT EDP BUDGETS FOR FORTUNE 500/50 COMPANIES, 1974-1980



- Peripherals included all equipment related to the central processing function including tape, disk, printers and data entry equipment.

- Minicomputers, termed secondary processors in 1974, included satellite computers, minicomputers, small standalone processors and turnkey systems.

- Terminals included CRTs, intelligent terminals, remote batch terminals and typewriter terminals connected over communication lines.

- Data communications included communications controllers, minicomputers for network management, modems, multiplexers and communications software.

- Software products included packages and services supplied at user sites by both computer manufacturers and independent vendors.

- Computer services included processing services and professional services, including educational services.

- "Other" expenditures included disks, tapes, paper, supplies and utilities.

- Total 1974 EDP expenditures for Fortune 500/50 companies were estimated at nearly $16 billion with a 1975/1974 growth rate just over 8%.

- Constrained by hiring freezes due to the recession, personnel expenditures remained under 40% of total 1974 budgets.

- In an era where most information processing costs were centralized in EDP, mainframe processors such as the 370/168 accounted for 12% of the total EDP budget.

- Changing to more efficient peripherals, including IBM plug compatible alternatives such as double density disk and tape drives, and installation of key/disk

systems and improved performance printers kept expenditures for peripherals high at 17% of total 1974 budgets.

- The beginning of a trend to use secondary processors to control peripherals as well as CRTs for remote data conversion and output saw minicomputers account for 3% of total expenditures in 1974.

- The planned shift from batch and remote batch to increased use of on-line interactive operations within data center proximity established CRT and intelligent terminal expenditures at 6% of total budgets.

- Data communications expenditures supporting terminal operations, primarily on private or direct line networks in local areas with increased use of communications processors, made up 2% of 1974 budgets.

- Fortune 500/50 respondents reported that 10% of total 1974 budgets were spent on the use of computer services to obtain networking, but the expressed intent was to move in-house as the situation permitted.

- With systems software primarily bundled by mainframe vendors, and the software applications package market still evolving, software expenditures accounted for only 1% of 1974 budgets.

- In 1974, paper accounted for over 66% of "other" expenditures, and amounted to almost 7% of the total EDP budget.

- In another multiclient study, EDP Plans and Budgets for 1977, INPUT interviewed 110 EDP and financial managers of Fortune 500/50 companies concerning their actual 1976, planned 1977 and expected 1978 U.S. EDP budgets. The sample included nearly 80% of those companies interviewed in the 1975 study. A comparison of the study results with those of the 1975 study showed annual EDP budget growth rates of:

  - 11.7% for 1976/1975.

- 10.2% for 1977/1976.

- 11.3% for 1978/1977.

- Although later samples include more than the Fortune 500/50 companies, and are therefore not strictly compatible with earlier findings, analysis of the reported EDP budgets from nearly 500 user respondents of all size companies contained in the survey sample for the User Planning Service 1978 Annual Report indicated a 12.4% 1979/1978 EDP budget growth rate.

- Similarly, analysis of EDP budgets from EDP manager respondents of companies with sales or assets in excess of $1 billion contained in the User Planning Service 1979 Annual Report indicated a 12.9% 1980/1979 EDP budget growth rate.

- The average annual growth rate (AAGR) in EDP budgets for the 1974-1980 timeframe just exceeds 11%, as shown in Exhibit I-2.

  - Relative growth varies somewhat between industries, with banking and finance having the greatest relative growth in EDP budgets among the six selected industries studied.

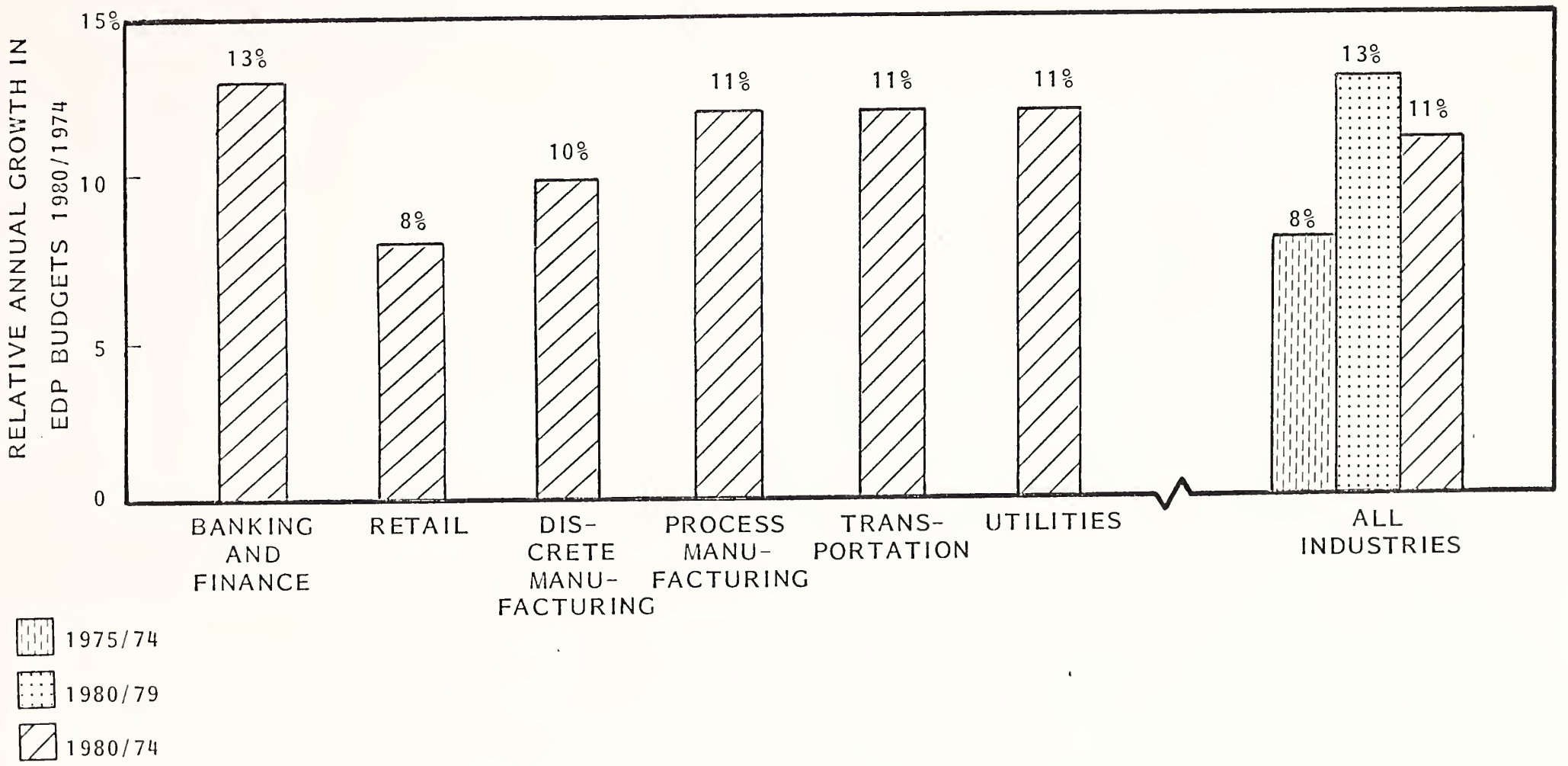
  - On a year-to-year basis relative growth in EDP budgets is increasing, reflecting the impact of acceleration in inflation rates in the late 1970s.

B. THE CURRENT SITUATION

- Results of the analysis of 1980 EDP budgets for nearly 140 large company respondents are also shown in Exhibit I-1. These respondents have annual

EXHIBIT I-2

RELATIVE GROWTH IN RESPONDENT EDP BUDGETS
FOR FORTUNE 500/50 COMPANIES, 1974-1980



revenues in excess of $500 million (that is, Fortune 500/50 size) and are contained in the EDP manager panel data for the User Planning Service 1980 Annual Report.

- Even though fueled by inflation and replacement of lower level data entry and data operations personnel with higher skill levels of analysis, systems programming and data communications personnel, 1980 personnel expenditures (at 46% of total EDP budgets) have risen only 2.5% annually relative to 1974.

- Expenditures for mainframe processors (including maintenance), at 13% of total EDP budgets, have risen less than 1% on an annual basis over the six-year period due to corresponding increases in mainframe price/performance.

  - Mainframe price/performance, even accounting for software overhead, increased at a 20% AAGR up to 1978, and jumped by a factor of four with the announcement of the IBM 3033, as reported in INPUT's report, Plug Compatible Mainframes: The New Hardware Economics.

- Meanwhile, peripheral expenditures have fallen to 10% of total 1980 budgets, decreasing at a 7.9% compound annual rate since 1974. The decrease is due to a number of factors:

  - Shift from tape to high capacity disk.

  - Shift to data entry on-line by end users.

  - Shift of high speed printers to remote locations as part of end user budgets.

  - Rapid decline in the cost of disk storage.

- Data were presented in INPUT's report, Image Processing Systems - Concepts and Status, that indicated IBM disk storage costs have decreased nearly 20% annually over the 1975-1980 timeframe.

- Spurred by distributed data processing, in particular distributed data entry and on-line inquiry, 7% of 1980 EDP budgets for Fortune 500/50 companies are allocated to minicomputers, a 16% relative annual growth in this budget component over six years.

- The terminal component of the 1980 EDP budget at 5% has declined at a 4% annual rate, while terminal intelligence has increased during the six-year period.

  - INPUT's study, Mass Storage and Other Peripheral Devices: Cost, Performance and Future Directions, forecast that CRT terminal prices, having declined 40% between 1977 and 1979, would continue to decline in 1980 as IBM removes the 3270 series price umbrella.

- Supporting distributed and on-line interactive processing, data communications expenditures have become nearly 4% of the total budget, an 11% relative annual increase in a budget component where cost performance has not appreciably changed over six years.

- The software component, still made up primarily of systems and utility packages, has risen to over 2% of total EDP budgets, a 9% relative annual increase from 1974 to 1980. Change in the software component is related to IBM's strategy of deriving increased revenue from systems software and software maintenance.

- The greatest decrease in EDP controlled budgets has occurred in processing services. In 1980, Fortune 500/50 EDP managers reported that only 2% of total budgets were used for outside processing services, an annual decline exceeding 23% over six years. The marked decline in this budget component

resulted from EDP manager-planned reductions in reliance on computer services vendors, primarily for general remote computing and facilities management services.

- The "other" budget component (primarily supplies), at 11% of total EDP budgets, has increased just over 2% per year, affected by a number of offsetting factors:

  - Decrease in use of punched cards.

  - Decrease in use of batch printed output.

  - Increase in use of microfilm media.

  - Increase in use of disk media.

  - Increased processor cost performance resulting in increased output.

- In summary, there have been some changes in the components of EDP controlled budgets between 1974 and 1980, but the changes have not been that great:

  - Three components (peripherals, terminals and computer services) have declined; only one, outside computer services, markedly (greater than 10% annually).

  - Three components (personnel, mainframe processors and supplies) have exhibited minimal increases (less than 5% annually).

  - Three components (minicomputers, communications and software) have become relatively more important.

  - Another budget component, maintenance, when broken out from existing hardware and software components, is expected to comprise about

1.5% of total EDP 1981 budgets and, because of recent IBM pricing strategies, is on the rise.

- Considering the relative increase in the size of EDP budgets for Fortune 500/50 companies, an 11% average annual growth rate against a corresponding annual inflation (production price index) rate of nearly 9% over the same six years, raises the question, "Why haven't EDP budgets and selected budget components increased more than they reportedly have?"

II EXPANDING END USER INFORMATION BUDGETS

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- INPUT studies in a number of areas indicate that total information processing expenditures are significantly greater than the EDP controlled budgets of Fortune 500/50 companies.

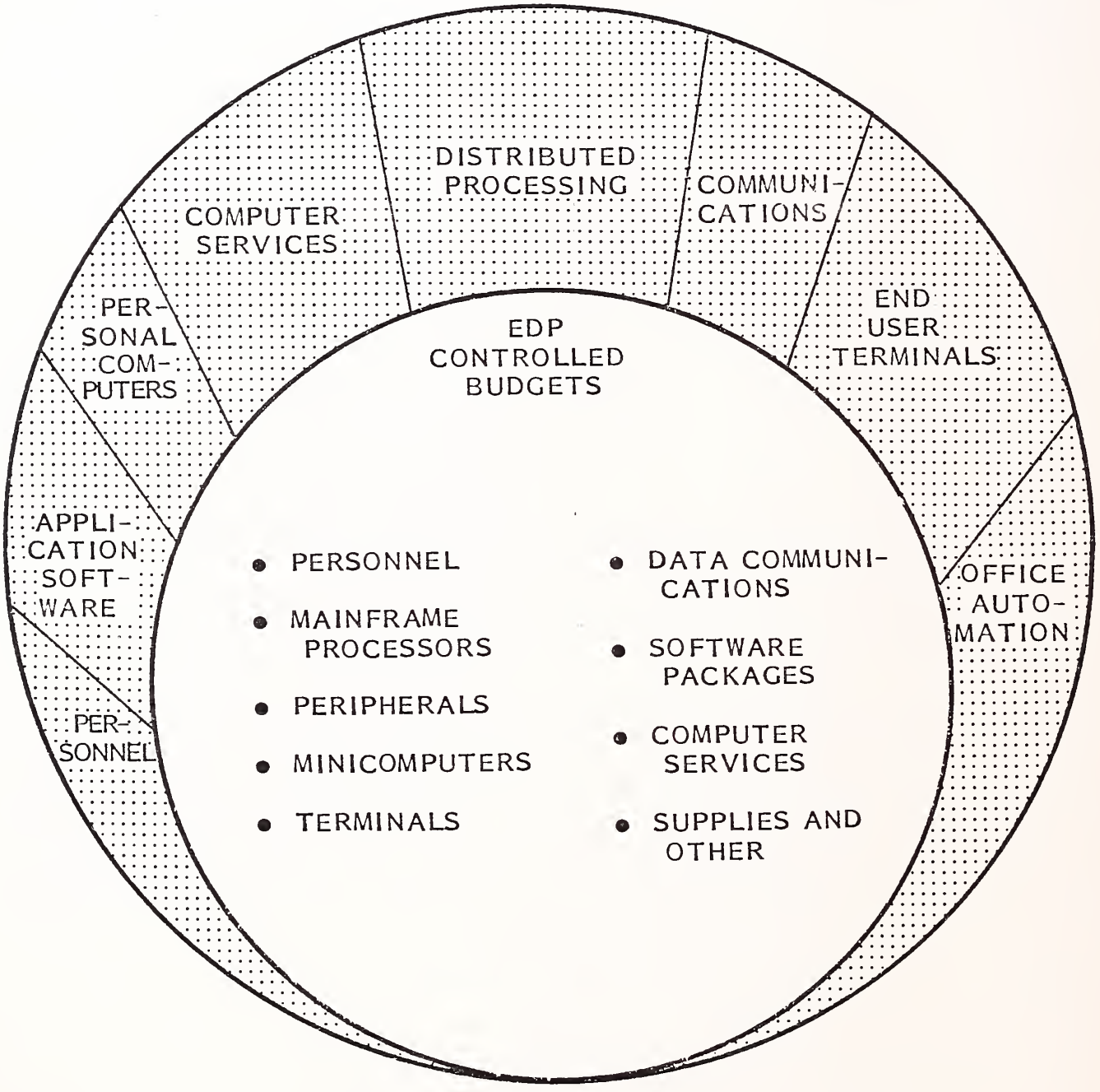
- INPUT has found that the key issue in the changing economics in the information organization lies not within EDP controlled budgets, but in the expanding end user information processing expenditures, budgeted and otherwise.

- The major implication of the changing economic situation is that the EDP executive, and hence the total organization, is losing control over the information system planning and control process.

- The components of the total information processing budget are shown in Exhibit II-1. The total budget is comprised of the EDP controlled budget plus end user components. Both EDP controlled budgets and total information processing budgets are seen as expanding but end user components, both budgeted and otherwise (as later shown below), are seen expanding at a great rate.

EXHIBIT II-1

COMPONENTS OF THE TOTAL INFORMATION PROCESSING BUDGET



EDP CONTROLLED BUDGETS

OTHER INFORMATION PROCESSING COMPONENTS IN USER AREAS

INF

A. SOFTWARE PRODUCTS

- INPUT's recently completed study, Opportunities in Marketing Applications Software Products, found that the applications software marketplace grew 25%/year during the 1975-1980 timeframe, reaching nearly $900 million in 1980.

- The study showed that end users as well as EDP managers are prime targets for selling software products, both for standalone minicomputers and for distributed processing systems.

- Key driving forces in rapid market growth have been:

  - Increased awareness by management of the availability of applications software.

  - Rapidly escalating costs of developing applications in-house.

  - Scarcity of qualified applications software development personnel.

  - Improved hardware cost performance for minicomputers and distributed processors as well as mainframes.

- INPUT's Market Analysis Service 1980 Annual Report indicated that the systems software market grew at a 26% annual rate for the 1970-1980 decade, exceeding $1.4 billion in 1980.

- The annual growth rate for software products is over 2.5 times that of EDP budgets over equivalent time periods. Assuming that only 40% of total software product revenues come from the Fortune 500/50 market segment, then the portion of total EDP budgets spent on software products should have approached 4% as opposed to just over 2%.

- The difference indicates that end users spend money on both applications and utility software, perhaps amounting to a greater portion of the total information processing budget than the amount spent by EDP managers.

B. PERSONAL COMPUTERS

- In its recently completed study, Selling Personal Computers to Large Companies, INPUT determined that:

  - The 1980 installed base of small computers (selling for under $15,000) in large (Fortune 500/50) corporations is $850 million.

  - The estimated number of these systems installed through 1980 is 85,000.

  - In terms of dollar value, the market is growing at an annual rate exceeding 40%.

- The study showed that over 60% of respondents' computers were bought without EDP group involvement.

- Clearly a definition of "personal computer" that extends to $15,000 includes some significant data processing capability. Many units are not purchased from end user information processing budgets. Personal computers and minicomputers are bought under such terms as "rate adjustors," "schedulers," or "model builders."

- "Controlled encouragement" best describes the attitude of some EDP directors, who cannot stop the influx of very small systems.

- The study findings imply that in excess of $300 million was spent primarily by end users, which is the equivalent of 1% of total 1980 EDP budgets in this information systems expenditure category.

C. COMPUTER SERVICES

- INPUT's Market Analysis Service 1980 Annual Report determined that the computer processing services industry (at $6.9 billion in 1979) grew at a 20% annual rate, exceeding $8.2 billion in 1980. Annual growth rates ranging between 17% and 20% have been consistently experienced by computer processing services vendors.

- Assuming that 40% of total computer processing revenues came from Fortune 500/50 companies, then the portion of total EDP budgets spent on computer processing services would exceed 9% as opposed to the reported decline to 2%.

- The discrepancy indicates that end users spend money on computer processing services, probably more than the amount spent for this category by EDP directors.

D. DISTRIBUTED PROCESSING

- INPUT's report, Distributed Data Processing Systems: Applications, Performance and Architecture, forecasted that the market for DDP hardware systems (primarily minicomputers and small business computers), comprising only $250 million in 1977, would exceed $1.6 billion by 1982, a 27% average annual growth rate.

- The study was based on 200 interviews conducted primarily with Fortune 500/50 companies.

- Significant findings of the study were:

  - Fourteen percent of respondents had or were in the process of implementing DDP systems.

  - Another 52% of respondents had DDP under active consideration.

  - Communications costs for approximately 33% of the respondents were not part of EDP controlled budgets.

  - The cost of remote site equipment for 66% of the respondents was not part of EDP controlled budgets.

  - DDP operational personnel costs were almost invariably part of remote facility budgets.

- As outlined in INPUT's vendor watch report, The Impact of Minicomputers and Distributed Data Processing Networks in the 1980s, the announcement of the IBM series 8100 and even more important, the IBM series 4300, both of which can be linked with SNA, will accelerate the shift toward DDP.

- Although many oranizations will continue to maintain large centralized mainframes and corresponding centralized EDP organizations, it is clear that distributed processing is causing "leakage" in EDP controlled budgets, resulting in increasing total information processing budgets.

E. COMMUNICATIONS

- INPUT's recently completed study, User Communication Networks and Needs, determined that the telecommunications market for Fortune 500/50

companies, $8 billion in 1980, conservatively represents 40% of the total market. Nearly $1.6 billion of this total is data related. The data related portion, forecasted to grow at a 24% AAGR, will exceed $4.5 billion in 1985.

- Some significant findings of the study were:

  - An average of nearly four separate data communications networks per company used an average of 220 lines.

  - Companies are making network changes at a faster rate than ever before; the major ones are consolidating data/voice, consolidating the number of separate data networks, and extending data networks to more end users.

  - Eighty percent of all the respondents are planning significant changes to their data networks.

- An earlier study, Network Implementation Alternatives, found that only 14% of Fortune 500/50 companies had centralized data, voice, and message communications under the responsibility of a single EDP executive, while in 36% of respondent organizations the EDP executive was not responsible for data communications planning at all.

- The annual growth rate (24%) for data communications is greater than the combined annual growth rate (11%) for EDP budgets and annual growth rate (11%) representing the relative increase in the data communications portion of EDP controlled budgets. The portion of total EDP budgets spent on data communications would exceed 5%, as opposed to under 4% as reported, if all of this growth were in the EDP controlled portion of the budget.

- In effect, control of approximately $400 million in 1980 data communication expenditures leaked to end users, only a portion of which were classified as data communications expenditures in the budget planning process.

F. TERMINALS

- Although EDP directors often control selection of on-line terminals, procurement of terminals through end user budgets is a widespread practice.

- Analysis of data from large organizations in INPUT's multiclient study, User Communication Networks and Needs, indicates that the average annual dollar growth rate for terminals is nearly 30%. Assuming that terminal prices are declining at a rate as high as 20% per year, then the net expenditure for terminals is increasing at least 10% annually.

- With reported total EDP budgets (in terms of current dollars) increasing at about 11% annually, and the terminal component decreasing at nearly 4% annually, net terminal expenditures from EDP controlled budgets are growing at most at 7% annually.

- The difference in terminal expenditure annual growth rates indicates that control of the terminal component of EDP controlled budgets is leaking to end users. End users are spending money on terminals, probably a greater portion of the total information processing budget than that controlled by EDP managers.

G. OFFICE AUTOMATION

- INPUT determined in its study, Managing the Integration of Office Automation in the EDP Environment, that total 1978 expenditures on computer and communications products to support office automation were less than 10% of the office personnel costs of over $72 billion. Office automation represents an enormous potential market for computer products and services.

- Although EDP managers almost universally recognize that, because word processing can categorize and store information, it is key to office automation, fewer than 60% of EDP managers in nearly 500 respondent companies had responsibility for word processing systems.

- Word processing systems currently being used by over 50% of respondents will be used by nearly 80% by 1985.

- In another office automation area, telecopiers, where EDP equipment manufacturers such as IBM, Xerox and Wang have been particularly active, only 33% of responding EDP directors had responsibility for plans or installations.

- Analysis in INPUT's report, The Impact of the Office of the Future, indicates that over 200,000 word processors are currently installed, and that the number will increase by a factor of five by 1985.

- Currently priced between $10,000 and $20,000, shared logic or communicating word processors with expanded capabilities are increasingly providing data processing-like facilities for their users.

- Assuming that no more than 40% of currently installed word processors are in Fortune 500/50 companies, and that at most 60% of EDP directors control budgets for word processing installations, then end users spent nearly $500 million in this one component of office automation in 1980. With the annual unit growth rate forecast at 38%, and unit prices forecast to increase because of the productivity gains offered through added functions, end users will likely be spending a greater portion of total information processing budgets on word processing systems than do EDP directors on the portion of the budget they control.

- Currently a smaller component of office automation expenditures, but forecast to grow on a unit basis by 15% annually up to 1985, a similar case can be made for telecopier or "information distribution systems" with respect to "leakage" in EDP controlled budgets.

H. PERSONNEL

- There are a number of factors that indicate the portion of total EDP budgets expended on EDP personnel should be growing at a considerably faster rate than the reported average annual rate of 2.5%.

  - Price performance of EDP hardware, in particular mainframes and disk storage, has increased by more than a full order of magnitude from 1974 to 1980, providing greatly increased capacity for automation of new functions, all requiring EDP personnel for analysis and programming.

  - The shift to on-line systems almost always requires redoing existing applications. Increased complexity in operating systems and in data base management systems extends development time. The net result is significantly greater demand for analysis and programming personnel.

  - When mainline applications approach the end of their useful system life cycle, EDP directors find that they must expend an increasing portion of scarce programming talent to incorporate user demanded changes, and fix "bugs" resulting from the upgrading of hardware and operating systems.

  - EDP directors are thus faced with the double burden of maintaining existing batch applications while developing and installing new on-line transaction driven systems.

- INPUT research outlined in its recently completed multiclient study, Improving the Productivity of Systems and Software Implementation, indicated that EDP directors are attempting to hold down EDP controlled personnel cost growth in three ways:

  - Implementing computer aids to increase software productivity.

- Improving planning and training.

- Increasing end user involvement.

- The study found that within large organizations (annual revenues greater than $1 billion), annual EDP personnel growth ranged from 0% to 10%, constrained by:

  - A shortage of qualified personnel who will work for anything like the existing salary levels.

  - A planned decision on the part of some organizations to hold the head count stable, or reduce it over time.

- While software productivity aids and effective system planning do contribute somewhat to programmer productivity, the study found that greater end user involvement is a major factor in improving programmer productivity.

- By involving the end user in information systems development, EDP personnel costs are transferred, either directly to end user EDP budgets, or indirectly to end user expenditures for information processing:

  - Directly to the extent of transferring EDP analysis/programming personnel to end user departments/budgets.

  - Directly by encouraging end users to hire or train personnel to program applications for distributed systems or to use corporate timesharing systems.

  - Indirectly by providing "menu driven" system and query languages which enable end users who are not trained in EDP to access, develop and use EDP systems.

- In summary, expanding unmet end user requirements pressing against limited EDP personnel resources are being met through "leakage" of the personnel component of EDP budgets to end users, resulting in an increase of the personnel component of total information processing budgets larger than the amounts shown on EDP budgets.

III THE EVOLVING INFORMATION SERVICES ORGANIZATION

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- The analysis presented above demonstrates that although the economics of EDP controlled budgets have changed from 1974 to 1980, budget components are not changing to the extent one might have expected when considering the rapid change in information processing technology over the same time period.

- The concept was presented that total information processing expenditures are composed of both EDP controlled expenditures and end user information processing expenditures.

  - Some of these expenditures are direct but others are indirect or "hidden" in other costs.

- The rationale was developed that selected components of total information processing budgets are known, or can be assumed, to be growing at a greater rate than corresponding components of EDP controlled budgets. This is occurring because users' budgets (direct and indirect) for selected components were found to be growing at a faster rate than the corresponding EDP budget component. The process through which this has come about INPUT has termed "leakage."

- By losing knowledge of and control over organizationwide information processing costs, the EDP directors' responsibilities for effective budgeting and planning are being seriously eroded.

- Now that on-line interactive systems are moving into all aspects of the organization's day-to-day business operations, top management is recognizing that computer information systems have become an integral part of doing business. Chief executives are recognizing that bottom line effectiveness, profitability and indeed even survival depend on the quality and performance of computer systems.

  - Information system workloads that are increasing 30% to 35% annually in large organizations, and the associated information processing expenditures, today only partially controlled, are receiving more management attention.

  - Operating management is beginning to view information as a factor of production, and to look upon the EDP organization to "pull its own weight" in the same way as other operating divisions or corporate profit centers.

- The trend toward rapid integration of computers, communications, and office systems appears irreversible, and requires effective strategic and long-range planning at the top level of the organization.

- INPUT believes that a future organizational structure similar to that shown in Exhibit III-1 will evolve in response to the changing economics of information systems. The essential elements of the future organization are:

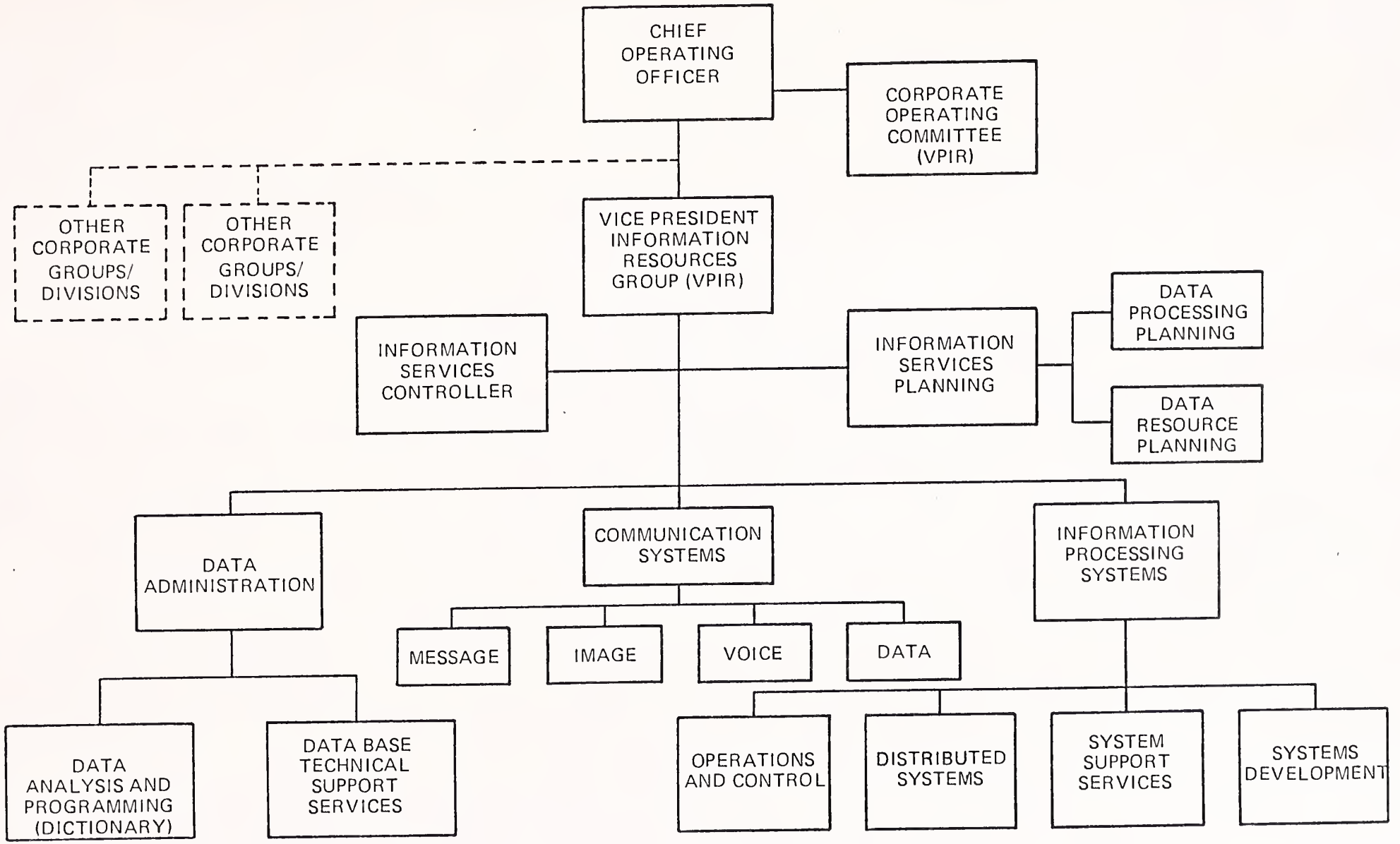
  - A single group executive responsible for information processing, communications, and data administration organization.

  - Assigned responsibility for advanced planning for the total information organization.

  - Responsibility for information budget allocation and accountability for performance against budgets.

EXHIBIT III-1

THE EVOLVING INFORMATION SERVICES ORGANIZATION



- Information processing systems, responsible for host facilities and distributed nodes.

- Communication systems, responsible for integrating and managing voice, data, message and image communication networks.

- Data administration, responsible for managing the company information base.

- Decentralization of system development activities, as possible, to end users, assisted by information processing, and data base support services.

- EDP executives who are prepared to move with the changing economics of the information organization will be able to influence operating management of the total organization, both in their evolving role in management of information as a resource and factor of production, and as members of executive operating committees.